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Olson

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[54] **RAIL ADAPTER HANDGUARD SYSTEMS FOR FIREARMS**

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[73] Assignee: **Knights Armament Company**, Vero Beach, Fla.

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[51] **Int. Cl.**[6] **F41A 21/00**

[52] **U.S. Cl.** **42/75.01**; 42/75.03

[58] **Field of Search** 42/75.01, 75.02, 42/103, 72, 71.01, 101, 102; 89/14.1, 37.01

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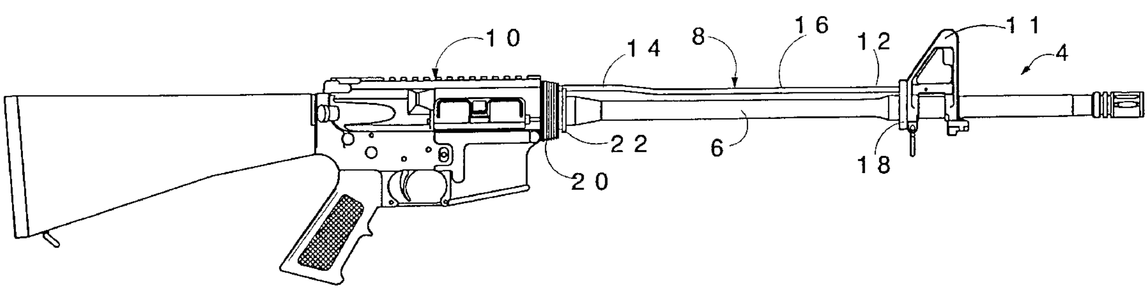
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[57] **ABSTRACT**

Improved rail adapter systems which enable firearms, including M16 type rifles and carbines, without any changes to the weapon except the handguard, to support accessory devices effectively even under combat conditions are provided via the invention by modification of the top semicylinderical part of the rifle's handguard attachment to include an elongated leaf spring arrangement in the front end and a unique rear clamp arrangement at the back end thereof so the leaf spring and rear clamp combination operate to compensate for thermal dimensional changes and combat abuse problems to maintain proper alignment of accessory devices attached to the weapon.

10 Claims, 5 Drawing Sheets



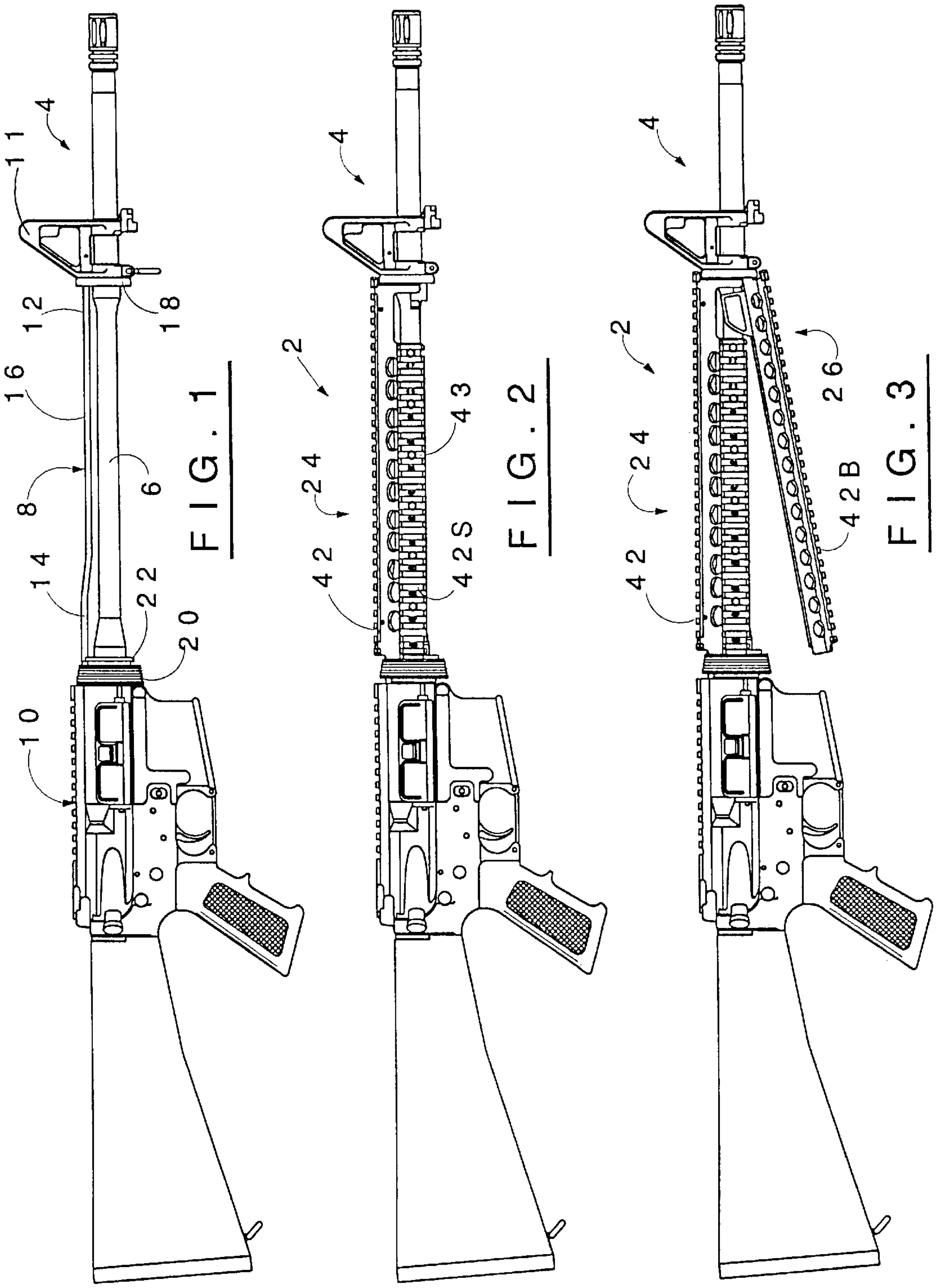


FIG. 1

FIG. 2

FIG. 3

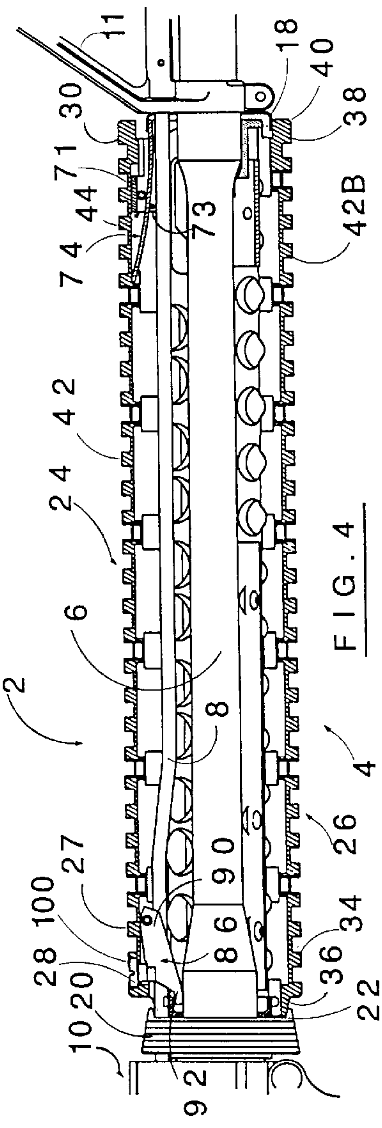


FIG. 4

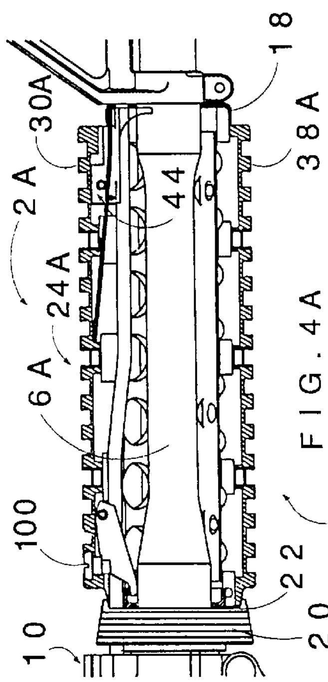


FIG. 4A

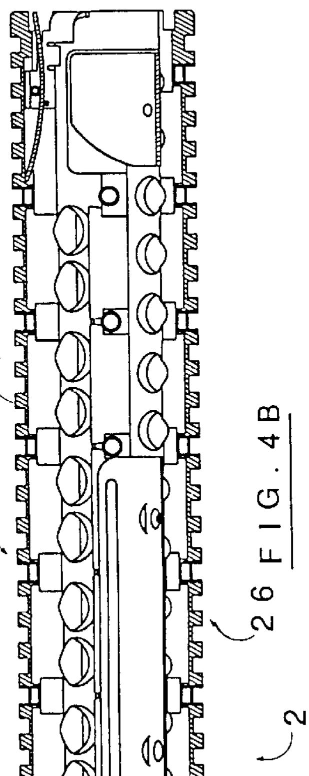
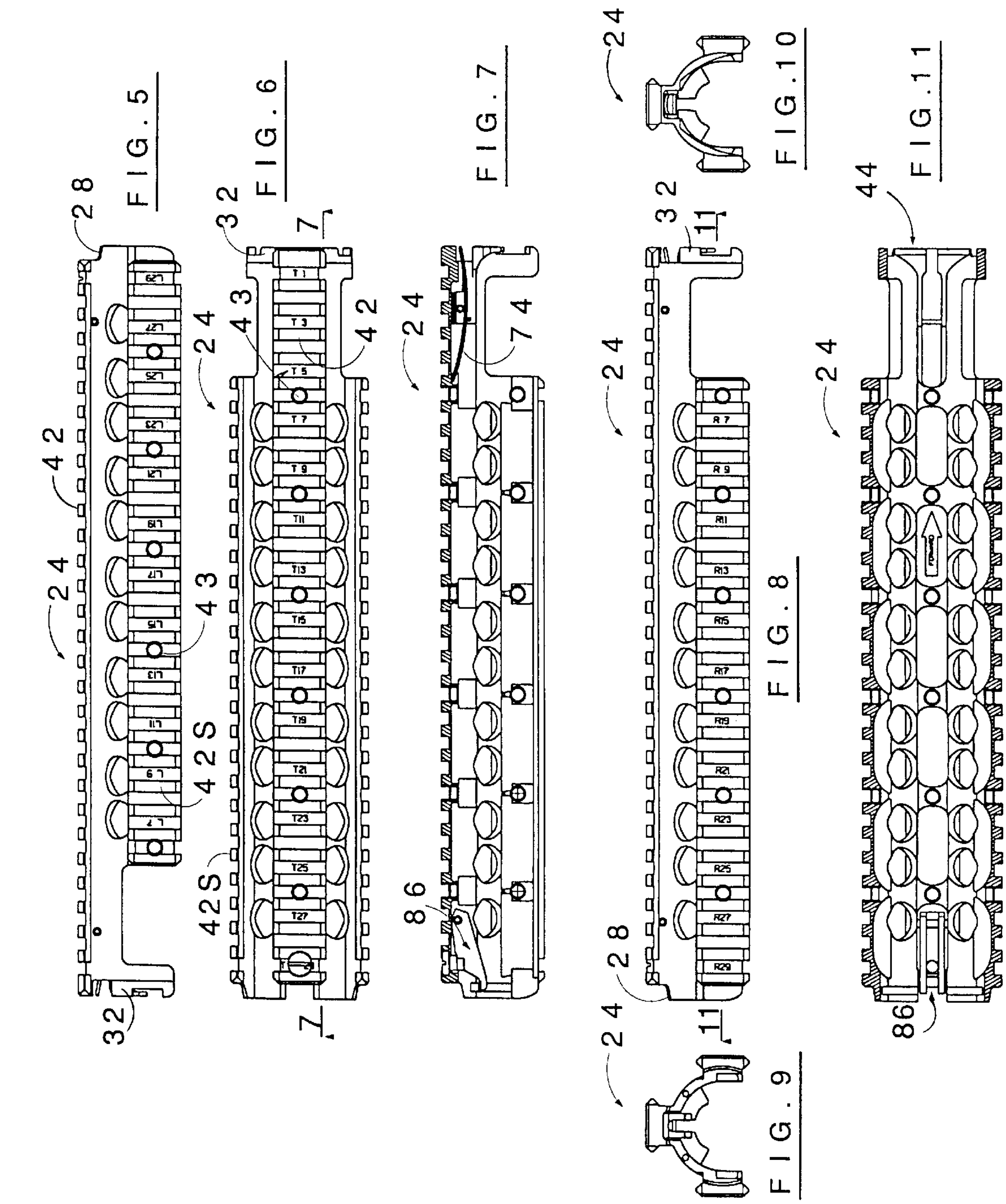
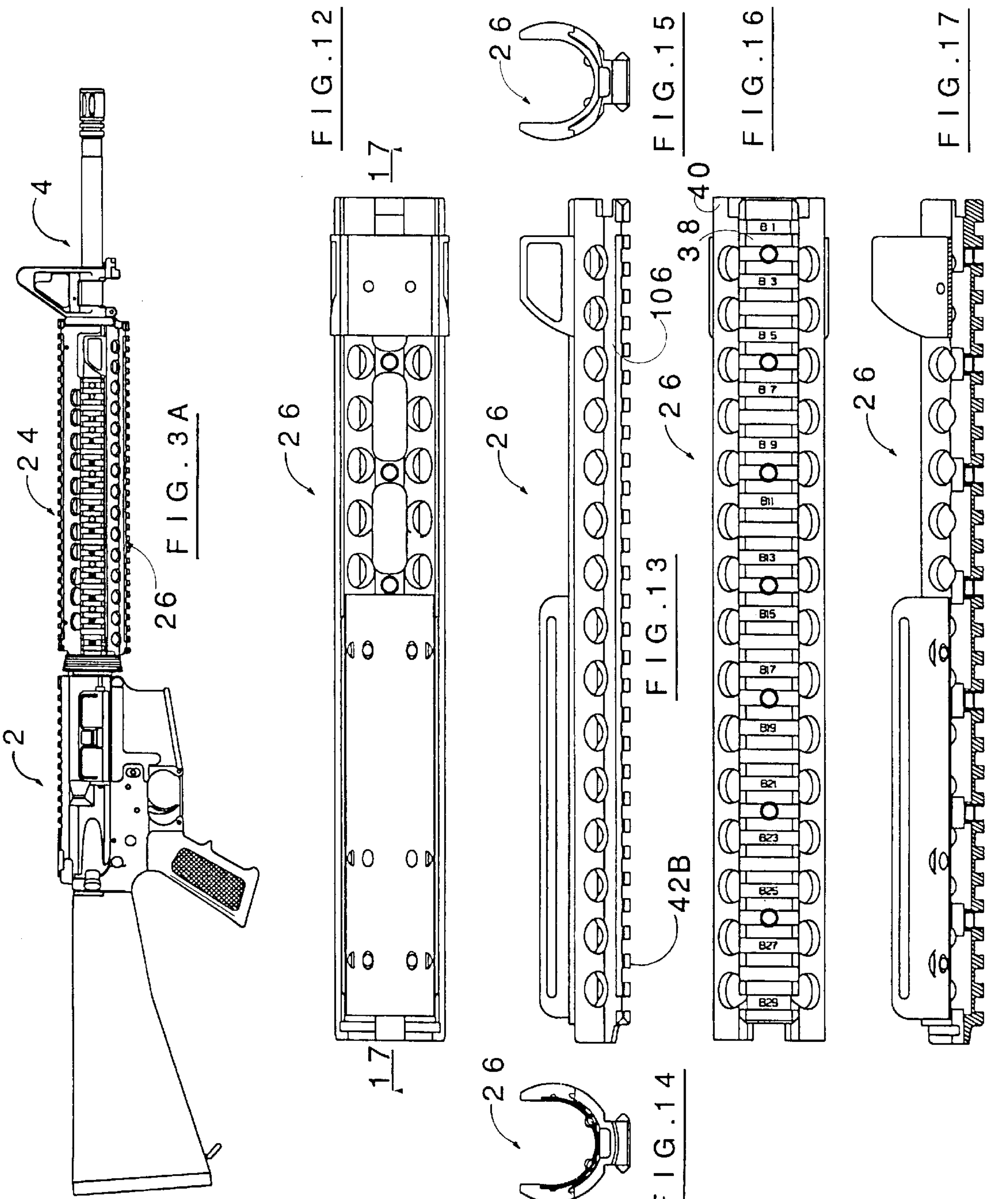


FIG. 4B


FIG. 5
FIG. 6
FIG. 7
FIG. 8
FIG. 9
FIG. 10
FIG. 11
24
28
32
42
42S
43
44
74
86
7
11


FIG. 3A
2
4
24
26
FIG. 12
17
FIG. 13
106
42B
FIG. 14
FIG. 15
FIG. 16
38
40
FIG. 17

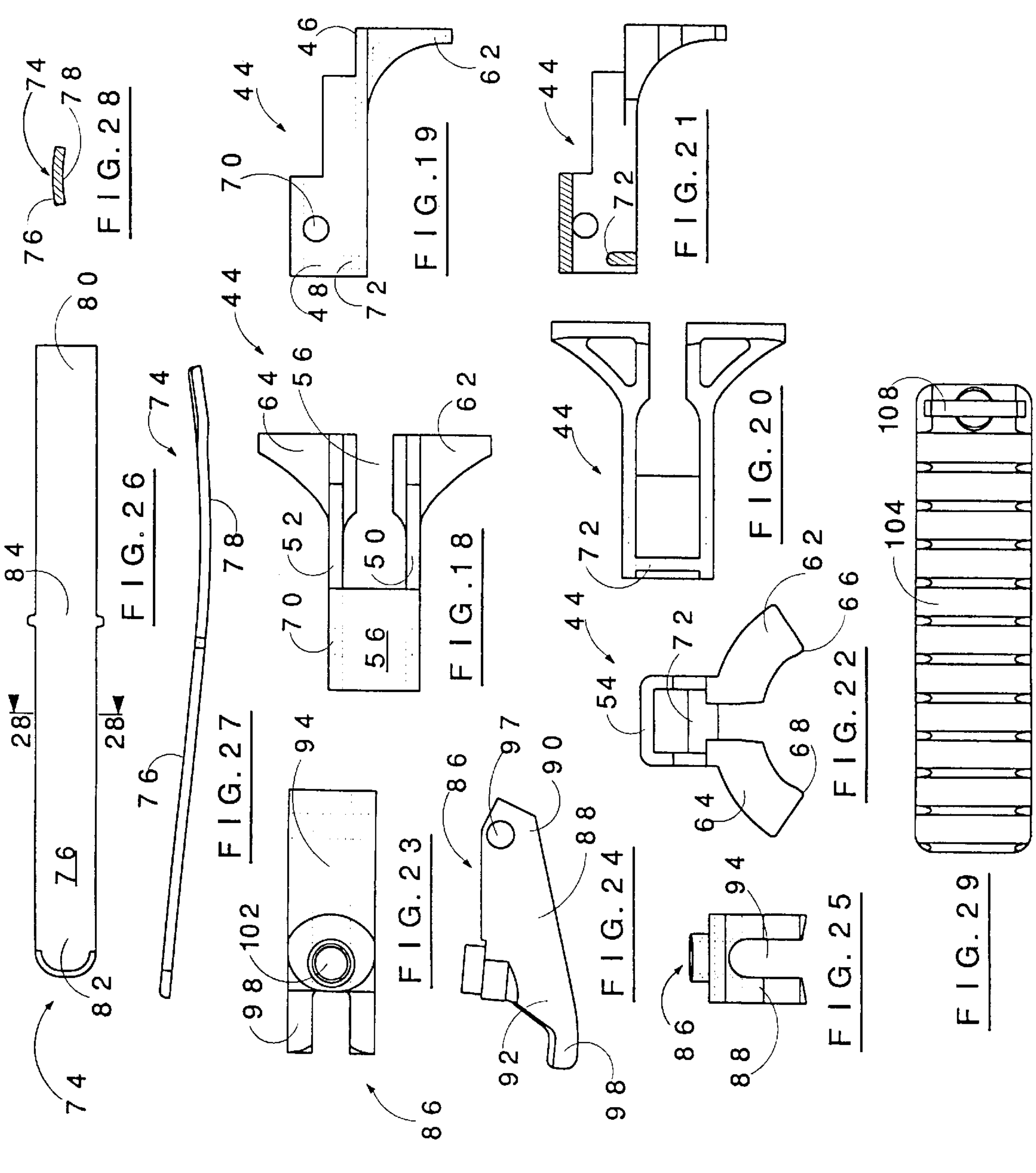


FIG. 18 FIG. 19 FIG. 20 FIG. 21 FIG. 22 FIG. 23 FIG. 24 FIG. 25 FIG. 26 FIG. 27 FIG. 28 FIG. 29

RAIL ADAPTER HANDGUARD SYSTEMS FOR FIREARMS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This application relates to handguard systems for the barrels of rifles, carbines, shotguns, machine guns and like firearms. More particularly, it concerns such handguard systems of an improved type having rail adapters to accept and effectively support accessory devices, e.g., infrared and night vision scopes, laser spotters and the like.

2. Description of the Prior Art

It is well known to those skilled in the art that rapid fire firearms utilized particularly in military operations, e.g., M16 type rifles, are characterized by the heating of the barrels to relatively high temperatures. At such temperatures, the barrels cannot be safely held by the person firing them. Consequently, a variety of handguards have been developed for such rapid fire guns to provide adequate cooling for the gun barrel and mitigate the possibility of burning the hand of the person firing the gun as disclosed in U.S. Pat. Nos.2,965,994, 3,075,314, 3,090,150, 4,536,982, 4,663,875 & 5,010,676.

With the continuing application of newly developed technologies, e.g., lasers, infrared ray scopes, microcomputerization, etc., to modern warfare, the basic combat weapon, i.e., rifles, carbines and shotguns, have become relatively complicated pieces of hardware. This has resulted in requirements for the association of these weapons with a variety of accessories such as infrared and night vision scopes, laser spotters and the like. Meeting this requirement has resulted in development of various types of multi-purpose rifle mounting devices, e.g., see U.S. Pat. Nos.4,026,054, 4,733,489, 4,845,871, 5,198,600, 5,343,650 & 5,590,484.

Because of the tremendous abuse to which firearms are continually subjected, particularly in combat, plus the need for as much simplicity as possible in construction and use of the weapon, very serious requirements and restrictions are encountered in the development of militarily acceptable systems for mounting accessories to firearms. The present invention has fulfilled these requirements while providing the art with improved handguard systems that incorporate rail adapters to accept and support accessory devices.

OBJECTS

A principal object of the invention is the provision of improved firearms handguard systems that comprise rail adapters to accept and support accessory devices.

A further object is the provision of such improved rail adapter systems (RAS) that require no permanent modification of the weapon with which they are used.

Another object is the provision of a RAS for M-16 type rifles that acceptably stabilize the RAS to the weapon.

An additional object is the provision of a RAS that is prevented from locking too securely to the weapon barrel.

Other objects and further scope of applicability of the present invention will become apparent from the detailed descriptions given herein; it should be understood, however, that the detailed descriptions, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent from such descriptions.

SUMMARY OF THE INVENTION

The objects are accomplished in accordance with the invention by the provision of new rail adapter systems that enable the mounting of additional accessory interface surfaces to a firearm in a way that keeps those surfaces in line with the barrel of the firearm yet with sufficient longitudinal travel to account for the varying expansion rates of dissimilar metals.

The prior art involved attaching these accessory interface surfaces to the AR-15 series of rifles in place of the original handguards. The prior art replacement handguard pieces include an upper portion with three accessory surfaces located at the nine o'clock, twelve o'clock and three o'clock positions. The lower replacement handguard has an accessory surface at the six o'clock position. The rears of the replacement handguards were originally held captive by the rifles spring loaded rear slip ring while the front of the upper replacement handguard was clamped upward to the front handguard clip. This arrangement proved to allow undesirable movement of the handguard when the rear slip ring was moved unintentionally or when the front handguard clip was loose on the weapon.

The unique attachment of the handguard in accordance with the invention creates an interface with the firearm that is not only more secure from unintentional movement, but is more accurately aligned with the barrel. The new system of the invention incorporates a clamp at the rear of the handguard that secures the handguard against the barrel retaining nut. This clamp straddles the gas tube and pulls up against an inner recess in the barrel nut. The clamping force is applied through the handguard and into its dowel pins that interface with two of the scallops on the barrel nut. The line of force provides a small moment that tends to force the front of the handguard downward toward the barrel.

The clamp is pivoted about a roll pin through the handguard to allow for a rotation of the clamp out of the barrel nut recess during removal and installation. The clamp works irrespective of the force applied by the rifles rear handguard clamp and thus the position of the upper handguard is maintained even when the rear slip ring is moved (as in removing the lower handguard to install a M203 Grenade Launcher). A screw provides the means for applying the force to the clamp relative to the handguard.

Since the original weapon design had no provision for supporting the front of the handguard against the barrel directly, the invention provides a new supporting interface. Such support straddles the gas tube leading from the front sight post and has two resting pads on the barrel sufficiently separated to provide a three-point support for the handguard. This support has sufficient flexibility so that a downward force from the handguard results in the two side pieces moving to firmly contact the sides of the gas tube. This pinching effect tends to remove all front rotational play from the handguard as well as preventing exterior loading from torquing the handguard.

A leaf spring provides an additional downward force on the front of the handguard by lifting up on the inside top of the rifle's front handguard clip. The leaf spring contacts the support piece behind its pivotal anchor to the handguard and thus tends to force the support piece toward the handguard. Keeping the loading directions correct is fundamental to holding the handguard tight against the barrel. This force is sufficient to hold the front of the handguard down upon the barrel, but not so much that the greater expansion of the aluminum handguard as compared to the barrel doesn't cause the alignment of the two to shift relative to each other.

The actual firing of the weapon causes the handguard to find its natural 'home' on the weapon. Excessive external forces can cause the handguard to shift out of this 'home'

position, but firing one or two shots will automatically return it to 'home'. Since there will always be some shock that would move the handguard out of position no matter how well secured it is, it has been discovered to be better that spring pressure and the firing of one or two rounds reset the handguard to its 'home' position rather than having excessive clamping pressure which can hold the handguard in an out of position location.

Thermal expansion of the aluminum handguard and the steel barrel produce movements relative to each other when the weapon is subjected to varying thermal extremes. In accordance with the invention, all of this movement is along the long axis of the barrel and thus when the handguard slips relative to the barrel, the points of aim of both the rifle and the handguard remain unchanged. In the case of a screw clamped front latch, the barrel and handguard do not slip relative to each other which causes point of aim shifts relative to each other. The latch is strong enough that it can hold the two parts in different locations when fired in prolonged situations. The force that the leaf spring applies is not sufficient to restrain the load that the thermal expansion can create. Thus the parts slide relative to one another as required. The end result is that accessories mounted to rapid fire rifles in accordance with the new improvements of the invention are so well stabilized that they are "combat effectively" supported.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the invention can be obtained by reference to the accompanying drawings in which generic parts of the illustrated matter are indicated by arrowhead lines associated with the designation numerals while specific parts are indicated with plain lines associated with the numerals and wherein:

FIG. **1** is lateral view of a typical rapid fire rifle weapon for which the invention provides improved handguard systems that comprise rail adapters to accept and support accessory devices.

FIG. **2** is a lateral view of the weapon of FIG. **1** with the top semicylinderical part of the handguard system of the invention installed on the weapon.

FIG. **3** is a lateral view of the weapon of FIG. **1** with the top semicylinderical part of the handguard system of the invention installed on the weapon and the bottom semicylinderical part being installed.

FIG. **3**A is a lateral view of the weapon of FIG. **1** with the top and the bottom semicylinderical parts of the handguard system of the invention installed on the weapon.

FIG. **4** is an enlarged lateral sectional view of top and the bottom semicylinderical parts of the handguard system of the invention installed on a rifle type weapon.

FIG. **4**A is an enlarged lateral sectional view of top and the bottom semicylinderical parts of the handguard system of the invention installed on a carbine type weapon.

FIG. **4**B is a sectional view corresponding to FIG. **4**, but with the conventional parts of the weapon removed.

FIG. **5** is a left side view of the top semicylinderical part of the new handguard system.

FIG. **6** is a plan view of the top semicylinderical part of the new handguard system.

FIG. **7** is a sectional view taken on the line **7**—**7** of FIG. **6**.

FIG. **8** is a right side view of the top semicylinderical part of the new handguard system.

FIG. **9** is a rear end view of the top semicylinderical part of the new handguard system.

FIG. **10** is a front end view of the top semicylinderical part of the new handguard system.

FIG. **11** is a sectional view taken on the line **11**—**11** of FIG. **8**.

FIG. **12** is a plan view of the bottom semicylinderical part of the new handguard system.

FIG. **13** is a right side view of the bottom semicylinderical part of the new handguard system.

FIG. **14** is a rear end view of the bottom semicylinderical part of the new handguard system.

FIG. **15** is a front end view of the bottom semicylinderical part of the new handguard system.

FIG. **16** is a bottom view of the bottom semicylinderical part of the new handguard system.

FIG. **17** is a sectional view taken on the line **17**—**17** of FIG. **12**.

FIG. **18** is a plan view of the front support member for the top semicylinderical part of the new handguard system.

FIG. **19** is a right side view of the front support member.

FIG. **20** is a bottom view of the front support member.

FIG. **21** is a right side sectional view of the front support member.

FIG. **22** is a front end view of the front support member.

FIG. **23** is a plan view of the clamp member for the top semicylinderical part of the new handguard system.

FIG. **24** is a right side view of the clamp member.

FIG. **25** is a rear end view of the clamp member.

FIG. **26** is a plan view of the leaf spring for the top semicylinderical part of the new handguard system.

FIG. **27** is a right side view of the leaf spring.

FIG. **28** is a sectional view taken on the line **28**—**28** of FIG. **26**.

FIG. **29** is plan view of one of a series of various length hand plates that can be attached to the semicylinderical parts of the new handguard system.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to FIG. **1** of the drawings, the present invention provides an improved rail adapter system for a otherwise conventional rapid fire rifle **4** which typically includes a barrel **6** having a gas tube **8** plus firing mechanism **10** and other usual parts, e.g., front sight **11**.

In the rapid fire rifles **4** to which the invention applies, the gas tube **8** is defined by a front end section **12** and a rear end section **14** integrally joined by a central section **16** extending longitudinally above the barrel **6**.

A circular receptor cap **18** is fixed to the barrel **4** to encircle the front end section **12** of the gas tube **8**.

A spring biased slip ring **20** is positioned about the barrel **6** rearward of the receptor cap **18** and a scalloped barrel nut **22** is carried on the barrel **6** juxtaposed to the slip ring **20** on the side facing the receptor cap **18**.

With particular reference to FIGS. **2**–**5**, the new handguard attachment **2** includes a top semicylinderical part **24** and a bottom semicylinderical part **26**. The top part **24** is defined by a back end **27** having back end ledge **28** that engages with the slip ring **20** and a front end **30** having front end ledge **32** that engages with the receptor cap **18** to retain the part **24** about the barrel **6**. Similarly, the bottom part **26** is defined by a back end **34** having back end ledge **36** that engages with the slip ring **20** and a front end **38** having front

end ledge **40** that engages with the receptor cap **18** to retain the part **26** about the barrel **6**.

An accessory adapter rail **42** extends longitudinally and upwardly from the top semicylinderical part **24**. The handguard attachment **2** may also include accessory adapter side rails **42S** and accessory adapter bottom rails **42B**. The adapter rails are preferably integral, but could can be affixed by rivets, etc.

A support member **44** is fixed to the front end **30** of the part **24** for positioning the part **24** upon the barrel **6**. Such support member **44** (see FIGS. **18–22**) is defined by a fore end **46**, an aft end **48** and comprises right longitudinal web **50**, left longitudinal web **52** and rear spanner **54**.

The spanner **54** fixes the longitudinal webs **50** & **52** spaced apart forming a longitudinal channel **56** therebetween.

A right lug **62** depends at the support member fore end **46** from the right longitudinal web **50** and a left lug **64** similarly depends from the left longitudinal web **52**. The right and left lugs **62** & **64** have contact points **66** & **68** respectively to engage the barrel **6** in the positioning of the top part **24** on the rifle **4**.

The support member **44** further has bores **70** to receive a pin **71** that fixes member **44** in the top part **24** and a transverse abutment **72**. A cross pin **73** (as shown in FIG. **4A**) held in bores (not shown) may be substituted for the integral abutment **72** as shown in FIGS. **19** & **21**.

As shown in FIGS. **26–28**, an elongated leaf spring **74** is defined by a top side **76**, a bottom side **78**, a fore end **80**, an aft end **82** and an integral central portion **84**. The fore end **80** is slidingly held by the receptor cap **18**, the central portion **84** is slidingly carried in the longitudinal channel **56** of support member **44**, the bottom side **78** of the central portion **84** slidingly engages lateral pin **73** fixed in the channel **56** between the right and left longitudinal webs **50** & **52**. The aft end **82** bears against the underside of the top part **24**. Alternatively, in the embodiment in which the abutment **72** is used in place of the lateral pin **73**, the central portion **84** slidingly engages the abutment **72**. In either case, the lateral pin **73** or the abutment **72** biases the top semicylinderical part **24** toward the barrel **6**. At the same time, the lateral pin **73** or the abutment **72** biases the fore end **46** of the support member **44** initially toward the top semicylinderical part **24** whereupon the top semicylinderical part **24** pushes fore end **46** of the support member **44** into contact with the rifle barrel **6**.

As shown in FIGS. **25–27**, the rear clamp **86** that comprises a body **88** has a stem end **90** and stern end **92** and contains a channel **94** that straddles the rear end section **14** of the gas tube **8**. The stem end **90** is pivoted for movement of the rear clamp **86** in a vertical plane upon pin **96** carried laterally within the top semicylinderical part **24** and through bores **97** in the body **88**. A pair of spaced apart lugs **98** extend aft from the stern end **92** for engagement with the barrel nut **22**. A screw fastener **100** extends through the adapter rail **42** and threads into a bore **102** in the body **88** whereby tightening of the screw fastener **100** serves to tighten engagement of the lugs **98** with the barrel nut **22**.

FIG. **29** shows one size of hand panels **104** that may be slid into place along a grooves in the top part **24** and bottom part **26**, e.g., groove **106** (see FIG. **13**) in the bottom part **26**, to cover portions of the any of the adapter rails **42**, **42S**, & **42B**. Leaf springs **108** snap into slots **110** in the adapter rails to hold the hand panels in position.

FIG. **4A** shows the shortened form of the new handguard attachment **2A** which is provided by the invention for use with a carbine **4A** type of firearm. In FIG. **4A**, the letter"A" is used to indicate those parts of the attachment **2A** that are modified to accommodate the shortened length of the carbine 4A, but otherwise correspond to their non-"A" numbered counterparts shown and described relative to the rifle 4 type firearm.

I claim:

1. In a handguard attachment for a firearm including a barrel and having a gas tube defined by a front end section and a rear end section integrally joined by a central section extending longitudinally above said barrel, a circular receptor cap fixed to said barrel to encircle said barrel and said front end section of said gas tube, a spring biased slip ring positioned about said barrel rearward of said receptor cap, and a barrel nut carried on said barrel juxtaposed to said slip ring on the side of said slip ring facing said receptor cap, said handguard attachment including a top semicylinderical part defined by a first front end portion and a first back end portion and a bottom semicylinderical part defined by a second front end portion and a second back end portion, said first and second back end portions having back end ledges that engage with said slip ring and said first and second front end portions having front end ledges that engage with said receptor cap to retain said parts about said barrel,

an improved rail adapter system which enables said firearm effectively to support accessory devices which comprises:

an accessory adapter rail extending longitudinally along said top semicylinderical part,

an elongated leaf spring defined by a top side, a bottom side, a fore end, an aft end and an integral central portion, said fore end being slidingly held by said receptor cap, said aft end slidingly positioned in said top semicylinderical part and said bottom side of said central portion slidingly engaging a lateral element fixed within said first front end portion below said adapter rail whereby to bias said top semicylinderical part toward said barrel, and

a rear clamp comprising a channelled body that straddles said rear end section of said gas tube having a stem end and stern end, said stem end being pivoted for movement of said rear clamp in a vertical plane upon a pin carried laterally within said top semicylinderical part, a pair of spaced apart lugs that extend aft from said stern end for engagement with said barrel nut and a screw fastener that extends through said adapter rail and threads into said channelled body whereby tightening of said screw fastener serves to tighten engagement of said lugs with said barrel nut.

2. In a handguard attachment for including a barrel and a firearm having a gas tube defined by a front end section and a rear end section integrally joined by a central section extending longitudinally above said barrel, a circular receptor cap fixed to said barrel to encircle said front end section of said gas tube, a spring biased slip ring positioned about said barrel rearward of said receptor cap, and a barrel nut carried on said barrel juxtaposed to said slip ring on the side of said slip ring facing said receptor cap, said handguard attachment including a top semicylinderical part defined by a first front end portion and a first back end portion and a bottom semicylinderical part defined by a second front end portion and a second back end portion, said first and second back end portions having back end ledges that engage with said slip ring and said first and second front end portions having front end ledges that engage with said receptor cap to retain said parts about said barrel,

an improved rail adapter system which enables said firearm effectively to support accessory devices which comprises:

an accessory adapter rail extending longitudinally along said top semicylinderical part,

a support member fixed to said front end of said top semicylinderical part for positioning said top semicylinderical part upon said barrel, said support member being defined by a fore end and an aft end and which comprises a pair of right and left longitudinal webs, a lateral web that fixes said longitudinal webs spaced apart forming a longitudinal channel therebetween, a right lug dependent at said support member fore end from said right longitudinal web and a left lug dependent at said support member fore end from said left longitudinal web, said right and left lugs having contact points to engage said barrel in said positioning,

an elongated leaf spring defined by a top side, a bottom side, a fore end, an aft end and an integral central portion, said fore end being slidingly held by said receptor cap, said aft end slidingly carried in said longitudinal channel and said bottom side of said central portion slidingly engaging a lateral element fixed in said channel between said right and left longitudinal webs whereby said lateral pin biases said top semicylinderical part toward said barrel, and

a rear clamp comprising a channelled body that straddles said rear end section of said gas tube having a stem end and stern end, said stem end being pivoted for movement of said rear clamp in a vertical plane upon a pin carried laterally within said top semicylinderical part, a pair of spaced apart lugs that extend aft from said stern end for engagement with said barrel nut and a screw fastener that extends through said adapter rail and threads into said channelled body whereby tightening of said screw fastener serves to tighten engagement of said lugs with said barrel nut.

3. The handguard attachment of claim **2** that comprises a plurality of accessory adapter rails extending longitudinally along said top semicylinderical part.

4. The handguard attachment of claim **2** that comprises an accessory adapter rail extending longitudinally along said bottom semicylinderical part.

5. The handguard attachment of claim **2** that comprises a plurality of accessory adapter rails extending longitudinally along said top semicylinderical part.

6. The handguard attachment of claim **2** that comprises an accessory adapter rail extending longitudinally along said bottom semicylinderical part.

7. The handguard attachment of claim **2** wherein said lateral element that engages said central portion of said leaf spring is a pin fixed between said longitudinal webs of said support member.

8. The handguard attachment of claim **7** wherein said lateral element is a pin fixed between said longitudinal webs of said support member and said pin engages said bottom side of said central portion of said leaf spring and initially biases said fore end of said support member toward said top semicylinderical part.

9. The handguard attachment of claim **2** wherein said lateral element that engages said central portion of said leaf spring is a transverse abutment fixed between said longitudinal webs of said support member.

10. The handguard attachment of claim **9** wherein said lateral element is a transverse abutment fixed between said longitudinal webs of said support member and said pin engages said bottom side of said central portion of said leaf spring and initially biases said fore end of said support member toward said top semicylinderical part.

* * * * *